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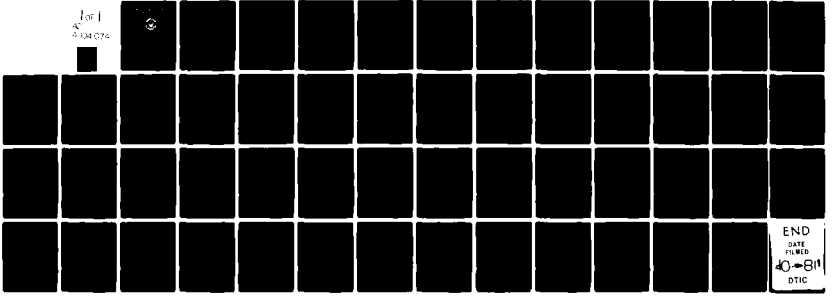

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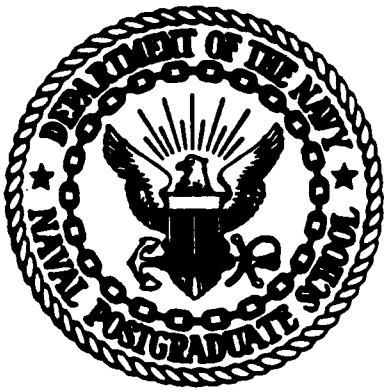

THESIS

FEASIBILITY OF NEW SELECTION CRITERIA
FOR THE VILLARD C. SLEDGE AWARD

by

Richard A. Clute

June 1981

Thesis Advisor: J. W. Creighton

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The Villard C. Sledge Memorial Maintenance Award is a valuable tool to maintain maintenance excellence and morale within the naval aviation community. This annual award is given to selected Intermediate Maintenance Activities for each model engine within each degree of maintenance.

This thesis evaluates the data sources used in the selection of the award, including those from organizational through intermediate level maintenance.

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It is concluded that the award criteria for selection is satisfactory at this time and should only be changed by reducing the number of engines inducted for First and Second Degree maintenance in the selection criteria.

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Feasibility of New Selection Criteria for the Villard C. Sledge Award

by

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Submitted in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE IN INFORMATION SYSTEMS

from the

NAVAL POSTGRADUATE SCHOOL
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ABSTRACT

The Villard C. Sledge Memorial Maintenance Award is a valuable tool to maintain maintenance excellence and morale within the naval aviation community. This annual award is given to selected Intermediate Maintenance Activities for each model engine within each degree of maintenance.

This thesis evaluates the data sources used in the selection of the award, including those from organizational through intermediate level maintenance. The use of the three degree maintenance concept in the evaluation is discussed. The Maintenance Data System is described with emphasis on the data flow.

It is concluded that the award criteria for selection is satisfactory at this time and should only be changed by reducing the number of engines inducted for First and Second Degree maintenance in the selection criteria.

TABLE OF CONTENTS

I. INTRODUCTION

A. PROBLEM STATEMENT

The Villard C. Sledge Award was named after a United States Navy Lieutenant Commander who devoted his entire 30-year naval career to Naval Aviation Maintenance. The award was inaugurated to provide recognition for Intermediate Maintenance Activities (IMA), that must closely mirror the high professional goals, and achievements associated with this pioneer of Naval Aviation Maintenance. This award was intended to provide an incentive for the continued search for maintenance excellence in the Intermediate Maintenance Activities community. This award is currently won by the activities reporting the highest number of engines processed, and the highest percentage of inducted engines repaired.

During the past years, there have been numerous complaints that some activities may be manipulating their reports so as to inflate the numbers upon which the award is based. For example, if a need for repair, even minor repair, is discovered while an engine is undergoing an "I" level inspection, the inspection Maintenance Action Form (MAF) will be closed out. This engine will then be inducted for repair. Upon completion of the repairs, the repair Maintenance Action Form will be closed out and the engine reinducted to complete the unfinished inspection. The Intermediate Maintenance Activity may then receive multiple credit for a single ready-for-issue (RFI) engine. There is also evidence that the fear of reducing their score may induce Intermediate Maintenance Activities to retain engines for local repairs along with complaints that some

are required to perform extensive repairs that could be processed more economically by other activities. Many Intermediate Maintenance Activities have complained that they are required to perform extensive repairs for which they receive no credit, i.e., Intermediate Maintenance Activities receive no credit for the Ready-for-issue assemblies and assistance they provide "O" level activities such as in the support of over-the-wing T-56 turbine changes.

B. OBJECTIVES

The objective of this research is to consider methods of determining and improving the Data Sources for the selection of winners of the Villard C. Sledge Award.

C. THESIS PLAN

Research was accomplished by first conducting an extensive literature search and then into existing ADP systems such as the Maintenance and Material Management (3M) System to ascertain the type, quantity, and quality of the data contained therein. Using this information, make a determination as to the source or sources of data best suited to supporting the selection criterion to be developed.

D. THESIS OUTLINE

The second chapter will provide background information to support subsequent chapters. First, a brief history of Lieutenant Commander Villard C. Sledge and the award named after him. The Intermediate level Maintenance will be briefly discussed followed by the Three Degrees of maintenance and the Maintenance and Material Management (3-M) System. Chapter III will discuss the Intermediate level gas turbine engine maintenance. Chapter IV goes into the Maintenance Data System and

discusses the purpose of the MDS, data flow, input concept, administration, correctness and validity, and the VIDS/MAF form. Chapter V describes the AIMD Engine Maintenance Evaluation Report.

II. BACKGROUND

A. BIOGRAPHY OF VILLARD C. SLEDGE

The Villard C. Sledge Award was named after Lieutenant Commander Villard C. Sledge USN who was born on 6 November 1921 in Florence, Alabama. After graduating from High School he enlisted in the Navy in 1941. He rose through the ranks having been appointed a warrant officer on 1 October 1959 and retired from the Navy after 30 years on 31 July 1971 as a Lieutenant Commander. On 10 January 1972 he passed away and was interred in Arlington National Cemetery.

Lieutenant Commander Sledge's entire Naval career was devoted to Naval Aviation Maintenance. His major efforts were oriented toward developing a comprehensive aviation maintenance system that would insure an outstanding professional maintenance program with safety of operation being the paramount goal. In recognition of those efforts, he was handpicked by flag rank and designated as project manager to establish a program that would resolve specific maintenance problem areas.

Because his technical knowledge in the aviation maintenance field was recognized and appreciated at all levels of naval aviation management and aviation commercial contractors, it was only fitting that the award for excellent performance at the intermediate level of jet engine repair be named after him. [Ref. 1]

B. THE VILLARD C. SLEDGE AWARD

Determination of the award recipients is based on two parameters: The number of engines processed and the percent of accomplishment, while concurrently adhering to the high maintenance standards which produce a completely thorough and professional work process. These maintenance standards require that accurate documentation of all maintenance actions be maintained by all activities and that the management of monthly and quarterly maintenance reports be utilized to monitor the actual shop process versus documentated shop process.

"Percent Accomplishment" is determined by engines which have either been repaired, tested and returned to service, inspected, or preserved and packaged as directed by higher authority for return to Designated Rework Point (DRP) in accordance with OPNAVINST 4790.2. This number will be reflected as a percentage of the total number of engines processed. A "Beyond Capability of Maintenance (BCM)" engine is counted as an asset when computing the percent accomplishment. A BCM engine is one that is forwarded to another maintenance activity because the forwarding activity is unable to perform the necessary maintenance. The BCM rate, expressed as a percentage, is the number of BCM engines divided by the total number of engines processed. Although high time engines and engines directed by higher authority are included in the BCM rate, they are also counted as an asset.

The selection of the most excellent intermediate maintenance activity for each model engine is based on the following information and procedure: In the Naval Air Systems Command Headquarters, the Maintenance Policy and Engineering Division will request a 3-M report on all engines

(Figures 1 and 2) and will outline the information in a modified report (Figure 3). This report will highlight two important parameters. First the number of engines processed and second the percent of accomplishment. Those two parameters form the axes of the grading graphs (Figures 4, 5, and 6).

Each intermediate maintenance activity will be plotted on the appropriate degree graph which is divided into sections by diagonal lines with a negative slope of 1 to 4 that will ensure the number of engines processed is equally weighted with the percentage of accomplishment. If more than one activity is in the highest section, lines of the same slope will be passed through the two points to determine the award recipient. If a winner is still not determined by these methods, then the next criterion to be considered is the percentage of repaired engines. [Ref. 2]

Only those intermediate maintenance activities which have been designated under the three degree program for a particular engine model for the full calendar year will be considered. If an intermediate maintenance activity has changed in degree assignment in the calendar year, the intermediate activity will be considered for an award at the lowest degree held during that year.

In order to qualify for an award, an intermediate maintenance activity must also meet the following minimum requirements:

1. A First Degree Activity must process a minimum of 50 engines of a particular model and must have repaired 25 or more engines. See Figure 4.

PERIOD - JAN 78 THROUGH DEC 78 AIMD ENGINE MAINTENANCE REPORT MSO 4790.A3063-01
DATE - 16 FEB 79 PAGE 11
TYPE EQUIP - J57 ENG

ENGINE	ACTIVITY	TOTAL ITEMS PROCESS	ATC C ITEMS	TOTAL BCM ITEMS	ATC 1 ITEMS	ATC 2 ITEMS	ATC 3 ITEMS	ATC 4 ITEMS	ATC 5 ITEMS	ATC 6 ITEMS	ATC 7 ITEMS	ATC 8/9 ITEMS	ATC 0 ITEMS	BCM 1 MAL 803/807 ITEMS	ATC A ITEMS
J57-P-10	AIMD KEY WEST	2	0	2	2	0	0	0	0	0	0	0	0	1	0
	AIMD ROTA	10	6	4	4	0	0	0	0	0	0	0	0	0	0
	AIMD ALAMEDA	14	3	4	4	0	0	0	0	0	0	0	5	2	2
	AIMD CUBI POINT	1	0	1	1	0	0	0	0	0	0	0	0	0	0
	AIMD AGANA	19	8	8	4	1	0	2	1	0	0	0	0	0	3
	AIMD PMIC PT MUGU	5	1	3	3	0	0	0	0	0	0	0	0	0	1
	TOTAL	51	18	22	18	1	0	2	1	0	0	0	5	3	6
J57-P-16	AIMD PATUXENT	1	0	1	1	0	0	0	0	0	0	0	0	0	0
	AIMD NORTH ISLAND	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	2	1	1	1	0	0	0	0	0	0	0	0	0	0
J57-P-420	A9R - UNKNOWN	7	1	5	5	0	0	0	0	0	0	0	1	0	0
	AIMD J F KENNEDY	1	0	1	1	0	0	0	0	0	0	0	0	0	0
	AIMD MIRAMAR	18	6	8	7	0	0	0	1	0	0	0	4	2	0
	AIMD NAS DALLAS	7	2	4	4	0	0	0	0	0	0	0	0	1	1
	AIMD PMTC PT MUGU	1	0	1	1	0	0	0	0	0	0	0	0	0	0
	TOTAL	34	9	19	18	0	0	0	1	0	0	0	5	3	1
	GRAND TOTAL	90	28	45	37	1	0	2	2	0	3	0	10	6	7

Figure 1

AIMD ENGINE MAINTENANCE EVALUATION REPORT

PERIOD - JAN 78 THROUGH DEC 78 AIMD ENGINE MAINTENANCE EVALUATION REPORT MSO 4790.A3063-01
DATE - 16 FEB 79 PAGE 12

TYPE EQUIP - J57 ENG

ACTIVITY	TOTAL ITEMS PROCESS	% TOTAL BCM ITEMS	% ATC 1 ITEMS	% ATC 2 ITEMS	% ATC 3 ITEMS	% ATC 4 ITEMS	% ATC 5 ITEMS	% ATC 6 ITEMS	% ATC 7 ITEMS	% ATC 8/9 ITEMS	% ATC 0 ITEMS	% MAL 803/807 ITEMS	% ATC C ITEMS	% ATC A ITEMS	% ACCOMP ITEMS
AIMD PATUXENT	1	100.0	100.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
AIMD KEY WEST	2	50.0	50.0	.0	.0	.0	.0	.0	.0	.0	.0	50.0	.0	.0	50.0
AIMD ROTA	10	40.0	40.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	60.0	.0	60.0
A9R - UNKNOWN	7	71.4	71.4	.0	.0	.0	.0	.0	.0	.0	14.3	.0	14.3	.0	28.6
AIMD J F KENNEDY	1	100.0	100.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
AIMD NORTH ISLAND	1	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	100.0	.0	100.0
AIMD MIRAMAR	21	42.9	23.8	.0	.0	.0	4.8	.0	14.3	.0	19.0	9.5	28.6	.0	57.1
AIMD ALAMEDA	14	14.3	14.3	.0	.0	.0	.0	.0	.0	.0	35.7	14.3	21.4	14.3	85.7
AIMD CUBI POINT	1	100.0	100.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
AIMD AGANA	19	42.1	21.1	5.3	.0	10.5	5.3	.0	.0	.0	.0	.0	42.1	15.8	57.9
AIMD NAS DALLAS	7	42.9	42.9	.0	.0	.0	.0	.0	.0	.0	.0	14.3	28.6	14.3	57.1
AIMD PMTC PT MUGU	6	66.7	66.7	.0	.0	.0	.0	.0	.0	.0	.0	.0	16.7	16.7	33.3
TOTAL	90	43.3	34.4	1.1	.0	2.2	2.2	.0	3.3	.0	11.1	6.7	31.1	7.8	56.7

Figure 2

AIMD ENGINE MAINTENANCE EVALUATION REPORT

J57 ENGINE SECOND DEGREE ACTIVITY	AMD NUMBER 1	IMA NUMBER 2	AMD NUMBER 3	IMA NUMBER 4	
TOTAL ITEMS PROCESS	21	19	14	10	
TOTAL BCM ITEMS %	11	8	4	4	BEYOND CAPABILITY MAINTENANCE
ATC-1 ITEMS %	7	4	4	4	NOT AUTHORIZED
ATC-2 ITEMS %	0	1	0	0	EQUIPMENT AND FACILITIES
ATC-3 ITEMS %	0	0	0	0	SKILLS
ATC-4 ITEMS %	0	2	0	0	PARTS
ATC-5 ITEMS %	1	1	0	0	BACKLOG
ATC-6 ITEMS %	0	0	0	0	TECHNICAL DATA
ATC-7 ITEMS %	0	0	0	0	EXCESS
ATC-8/9 ITEMS %	0	0	0	0	BUDGET/CONDEMN
ATC-0 ITEMS %	4	0	5	0	INSPECTED
MAL 803 ITEMS %	12	0	2	0	HIGH TIME
ATC C ITEMS %	16	18	13	6	REPAIRED
ATC A ITEMS %	0	3	2	0	TESTED RETURNED
ACCOMPLISHED %	57.1	57.9	85.7	60.0	%

MODIFIED AIMD ENGINE MAINTENANCE EVALUATION REPORT

Figure 3

FIRST DEGREE IMA

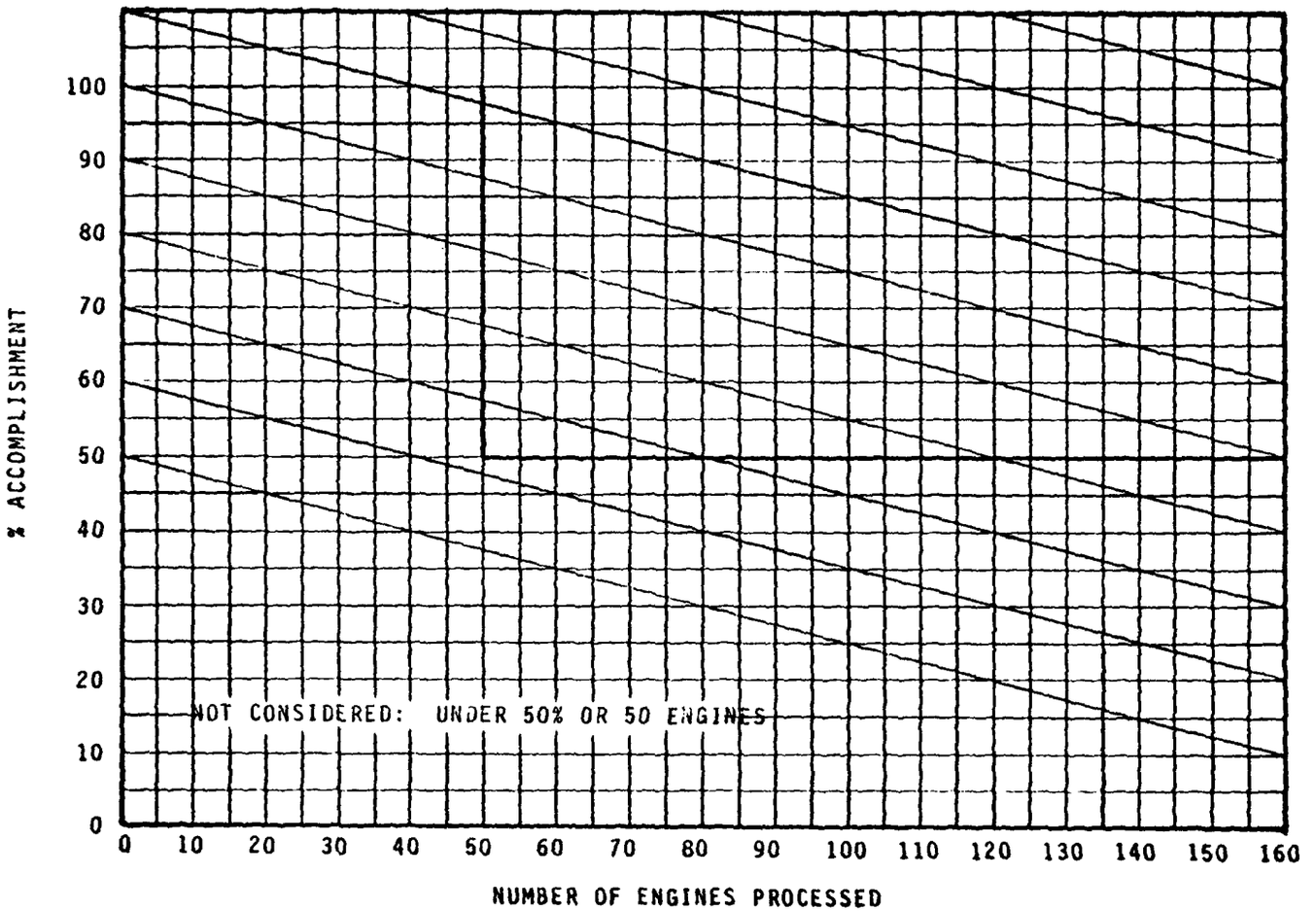


Figure 4

2. A Second Degree Activity must process a minimum of 20 engines of a particular model and must have repaired 10 or more engines. See Figure 5.

3. A Third Degree Activity must process a minimum of 10 engines of a particular model and must have repaired 5 or more engines. See Figure 6.

A certificate of excellence will be awarded to the most superior intermediate maintenance activity at each degree of intermediate maintenance for each engine model. This certificate will be known as The Villard C. Sledge Memorial Maintenance Award, in honor of a highly devoted naval officer whose dedicated service is cited in Section (A) of this chapter.

C. INTERMEDIATE LEVEL MAINTENANCE

Intermediate maintenance is that upkeep maintenance which is the responsibility of, and is performed by, designated maintenance activities in support of using organizations. This work normally consists of calibrations; off-equipment repair or replacement; repair or replacement of damaged or unserviceable parts, components, or assemblies; the manufacture of certain unavailable parts. Intermediate maintenance may include the performance of certain periodic inspections and providing technical assistance at the organizational level. The intermediate level of maintenance includes the following:

1. Repair, test, inspection, modification and/or check of aeronautical components/equipments and related support equipment.

2. Intermediate level calibrations of designated equipments.

3. Processing of aircraft components/equipments stricken

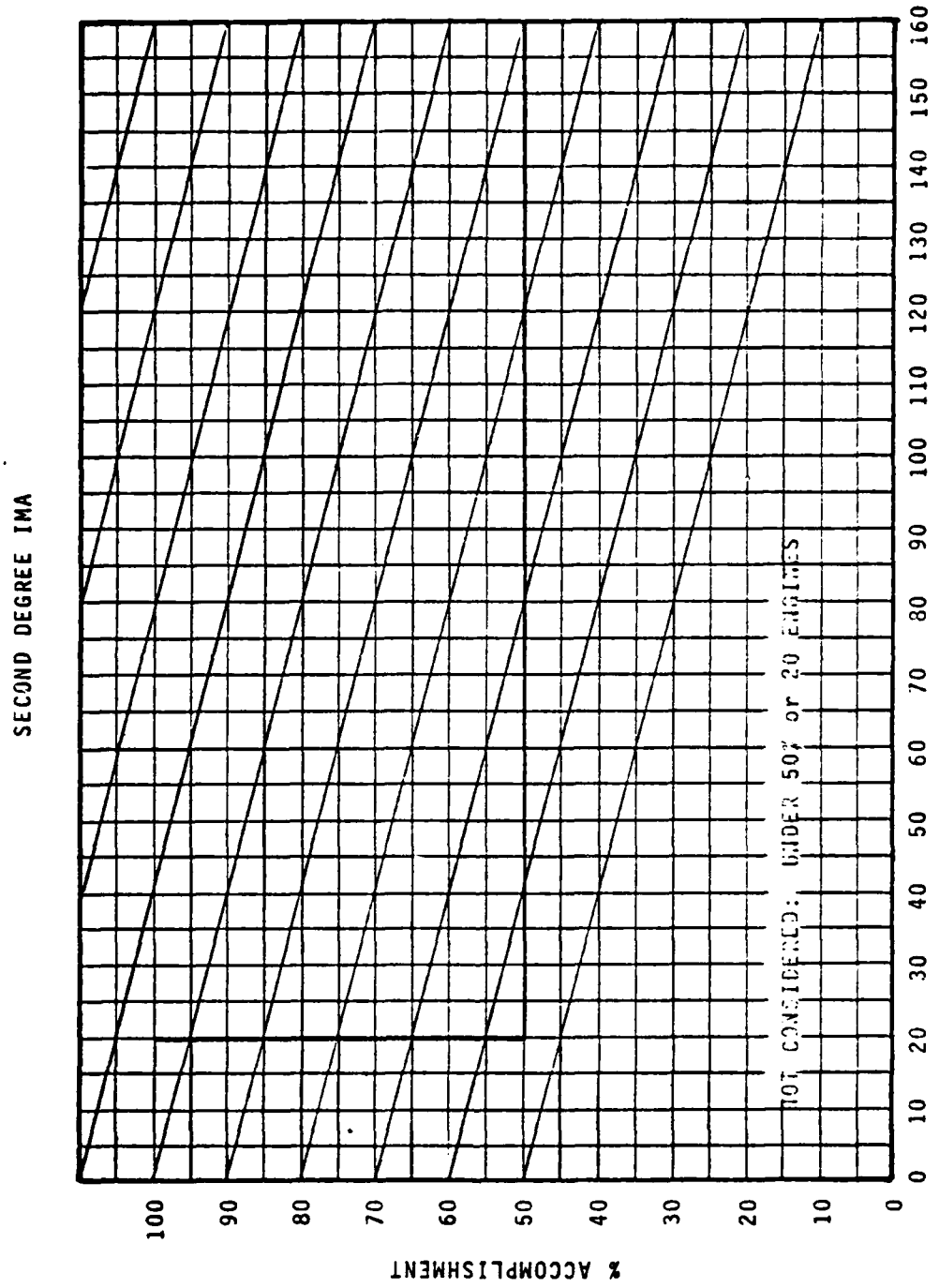

SECOND DEGREE IMA
% ACCOMPLISHMENT
100
90
80
70
60
50
40
30
20
10
0
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
NUMBER OF ENGINES PROCESSED
NOT CONSIDERED: UNDER 50% or 20 ENGINES

Figure 5

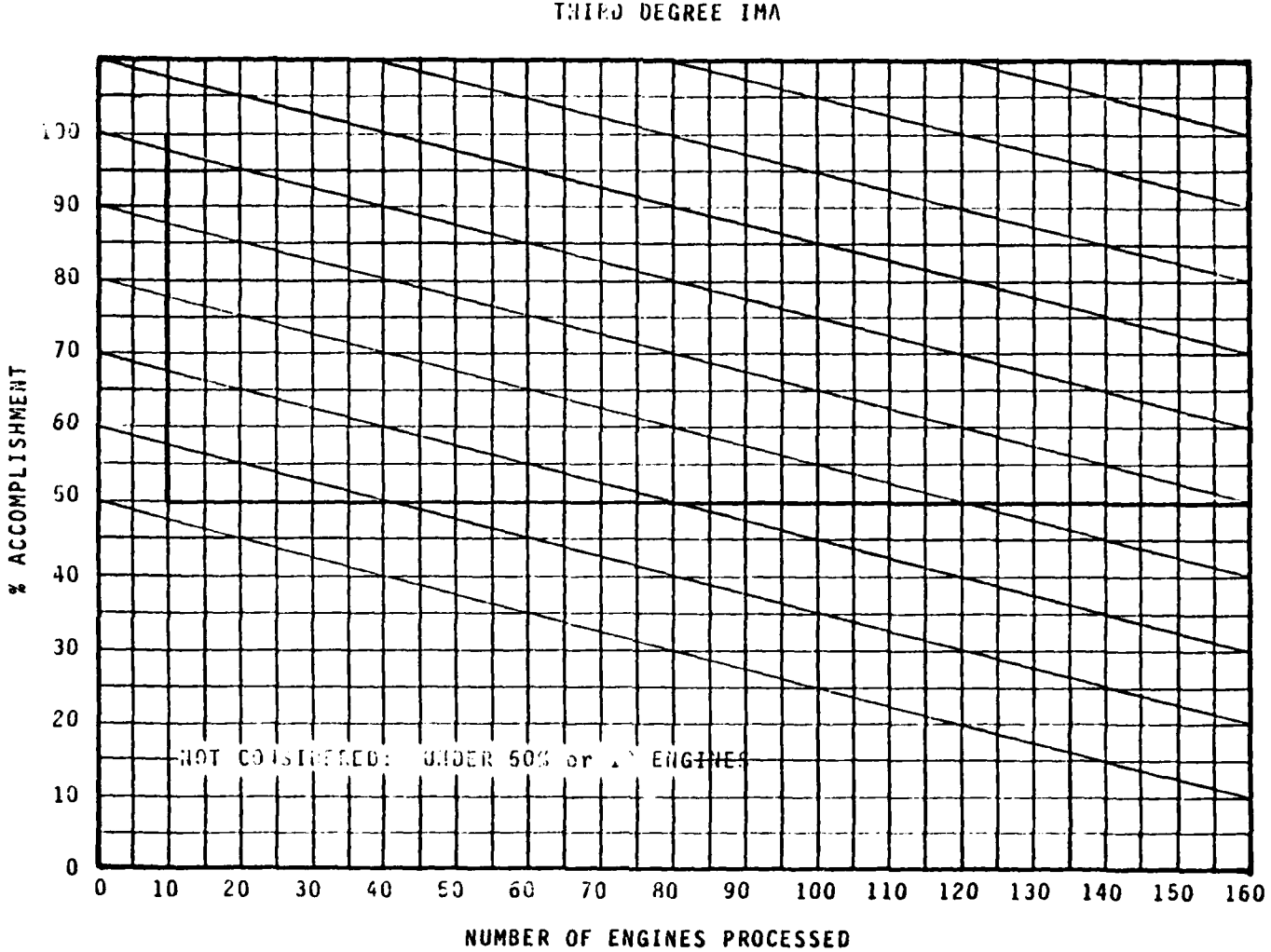

THIRD DEGREE IMA
% ACCOMPLISHMENT
100
90
80
70
60
50
40
30
20
10
0
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
NUMBER OF ENGINES PROCESSED

Figure 6

from aircraft.

4. Technical assistance, when required, to the organizational levels supported.

5. Perform selected functions normally accomplished at depot level only.

6. Incorporate designated technical directives. [Ref. 3]

D. THREE DEGREE INTERMEDIATE LEVEL MAINTENANCE

Not every activity classified as an intermediate maintenance activity can perform the identical maintenance as some other intermediate levels because each is not provided the identical level of support. It is for this very reason that the concept of three degree intermediate level maintenance has been developed.

The objective of the concept is to provide a consistent framework for all intermediate level activities to perform various depths of maintenance on components. The definition provided earlier for the intermediate level maintenance still applies; however, further consideration is given to both the functions which can be performed on a component, and the resources required to accomplish the functions. Subsequently, the maintenance functions and corresponding resources required are categorized into one or more of the three degree classes. The structure of the three degree concepts is such that the least difficult functions are classified as third degree; slightly more difficult functions are classified second degree; the most difficult functions are classified first degree. [Ref. 4]

Intermediate levels are assigned specific degree maintenance responsibility on a component-by-component basis commensurate with their

respective ability/need to perform various depths of maintenance. The degree maintenance responsibility assigned to an intermediate level is in consonance with mission requirements. An activity will not normally be assigned a degree of maintenance which would not allow it to meet its mission requirements. A significant characteristic of the three degree concept is that assignment of maintenance functional responsibility is made on a component-by-component basis and in accordance with individual maintenance activity support requirements.

E. MAINTENANCE AND MATERIAL MANAGEMENT SYSTEM

The Standard Navy Maintenance and Material Management (3-M) System, directed by the Chief of Naval Material (CNM), has been in operation at the organizational and intermediate levels since early in 1965. The system is designed to collect and process data in order to provide informational reports concerning the maintenance of Navy and Marine Corps equipments. The 3-M System incorporates both the use of a Planned Maintenance System (PMS) and a Maintenance Data System (MDS). Through the use of the PMS, the maximum operational efficiency of all Fleet equipments is attained and maintained, equipment downtime is reduced to a minimum consistent with good maintenance practice, and the cost of maintenance in both money and man-hours is reduced. Through the use of the MDS, a means is provided for gathering data directly related to maintenance. The data can then be analyzed and displayed to show the relationship of corrective maintenance to preventive maintenance which in turn can be used by management to improve the maintenance effort. [Ref. 5]

The System is designed to provide command, field activities, and other data users access to information drawn from the exceptionally broad data

of the 3-M System. The data will provide in-depth information concerning the expenditure of resources, the maintenance of equipments, and the nature of equipment failures. This information will prove useful in defining equipment problem areas in terms of their effect upon reliability, availability, maintainability, and cost.

III. INTERMEDIATE LEVEL ENGINE MAINTENANCE

A. GAS TURBINE ENGINE

The Naval Aviation Maintenance Program (NAMP) provides the basic concepts and guidelines which represent the engine maintenance program policies of NAVAIR. The objectives of the program are to prescribe policy and procedure for the application and monitoring the performance of maintenance required in support of gas turbine engines at various levels of maintenance. The Complete Engine Repair (CER) Program was initiated in 1958 to establish the necessary support criteria and management guidelines to achieve shorter turnaround times, increasing time between overhauls and reducing the number of unserviceable engines in the Navy inventory. Another concern which promoted the development of the CER Program was the awareness by management of the sizeable inventory dollar investment in aircraft engines and the continually rising cost of new engine models. The CER Program provided management with the capability to establish controls so as to reduce and maintain a lower new acquisition requirement for aircraft engines. [Ref. 6]

The three degree concept has evolved with the continual efforts of maintenance management to improve aircraft gas turbine engine maintenance

support posture. This concept is intended to provide specific guidelines and responsibilities throughout the aviation maintenance community for the management of all gas turbine engines installed in the Navy and Marine Corps aircraft. It is intuitively obvious that is is not economically feasible to establish identical maintenance capability at each and every intermediate maintenance activity (IMA), for each and every aircraft engine Type/Model/Series supported. Additionally, the operating scenario of each activity limits the extent to which it can accomplish certain maintenance functions. That is, shore-based IMA's and afloat IMA's are equipped differently by virtue of the environment in which they are located. The three degree maintenance concept recognizes the environmental factor, in terms of an IMA having the capability to accommodate the resources required in support of a component. Certain types of support equipments will require more space than a ship can afford; certain test requirements cannot be accomplished aboard ship for lack of proper facilities. These type factors for determining the most effective and practical assignment of maintenance responsibilities to each intermediate level activity is considered by the three degree concept.

Appendix A contains terminology to be used in the discussion that follows on aircraft engine maintenance. These engine maintenance activities are not designated a specific degree maintenance responsibility across-the-board. That is, it would not be correct to say that NAS Miramar is a first degree activity for all gas turbine engines. Rather, NAS Miramar is a first degree activity for a specific gas turbine engine Type/Model/Series: e.g., the J-79, all Type/Model/Series; the J-57-22/420. Additionally, NAS Miramar is authorized second degree maintenance

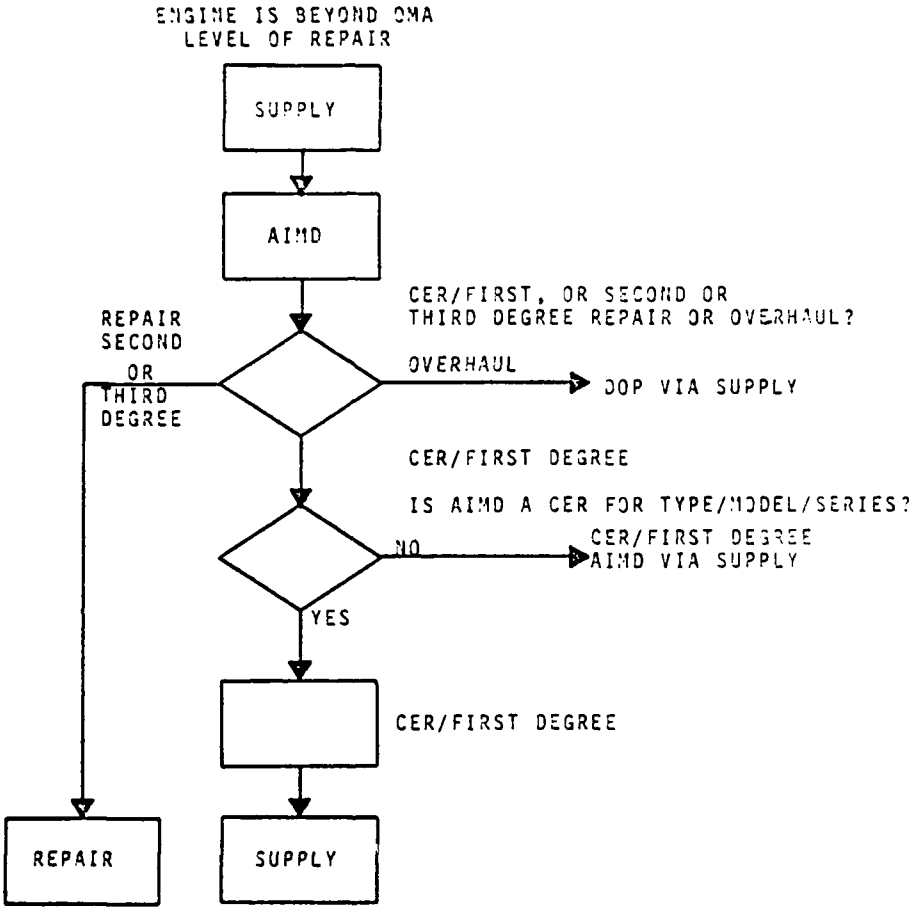
responsibility for the T-56-8/425/426. It follows that NAS Miramar is not authorized and is not responsible for performing first degree maintenance of the T-56-8/425/426. It is conceivable that, in addition to performing first degree maintenance for the engine Type/Model/Series for which the activity has first degree responsibility, the activity would be expected to support nearby activities not having first degree capability/authority. An activity having a lesser capability may seek support from a higher level activity contingent on the higher degree classified activity being capable of accommodating the lesser capable activity. This characteristic of the three degree concept also applies to similar criteria for second and third degree activity interfaces.

The whole process commences at the Organizational Maintenance Activity (OMA) level. A decision is required at the OMA level for each reported engine malfunction as to the type maintenance actions necessary to correct the malfunction. Typically, corrective actions not requiring removal of the engine from the aircraft are performed at the OMA through removal and repair/replacement of defective component parts. Engines requiring removal from the aircraft are processed through the local supply system for disposition. Depending upon the nature of the malfunction and the type maintenance required to return the engine to serviceable condition, a determination is made whether or not corrective actions can be accomplished by the local IMA. Documentation in the form of NAVAIR Notice 4700 identified each activity and their respective authorization to perform specific degree maintenance functions by aircraft engine Type/Model/Series. [Ref. 7] Additionally, individual engine Maintenance Instruction Manuals (MIM) are structured so as to

correlate maintenance functions and associated support resources required for specific maintenance operations. The Aircraft Intermediate Maintenance Departments (AIMD) can readily determine if the engine can be repaired locally. Maintenance requirements beyond the local intermediate level capability require that the engine be processed to the nearest activity having the capability, and capacity, to effect necessary corrective actions.

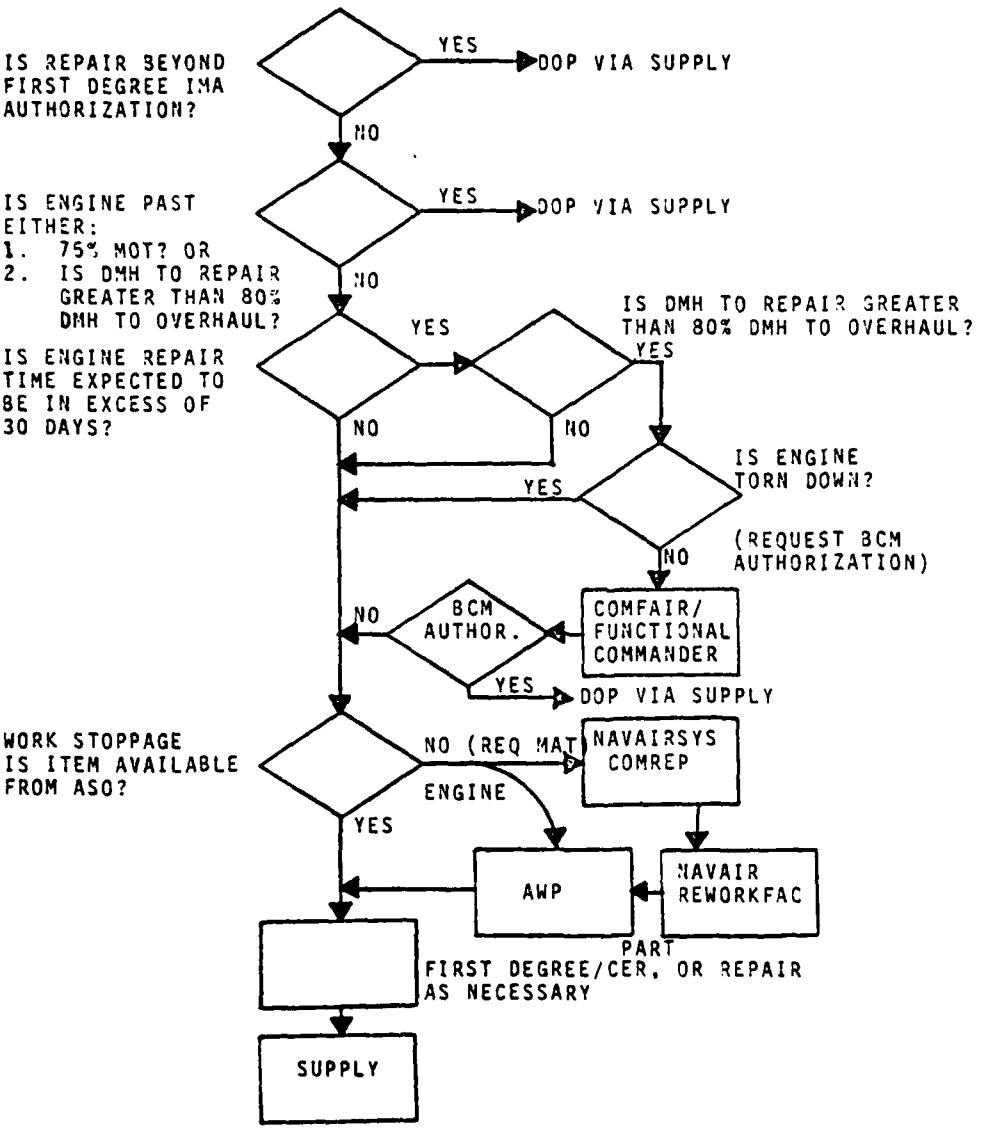
Figures 7 and 8 illustrate the decision making process for purposes of screening rejected engines. If the malfunction of the engine cannot be corrected at the organizational level, the defective engine is forwarded to the local supply system and a replacement engine, if available, is returned to the organizational activity. The rejected engine presently in the local supply system is considered in terms of the degree of maintenance required and the autorized degree of maintenance for the local intermediate maintenance activity. Engines beyond the capability of the local activity are forwarded to the appropriate level which can effect appropriate corrective action.

Engines processed at CER/First Degree are subject to additional detailed screening criteria as indicated in Figure 8. Considerations are made in terms of the Maximum Operating Time (MOT) which refers to the amount of time an engine has been in operation relative to its scheduled overhaul. If the engine has exceeded 75% Maximum Operating Time, it must be forwarded to its Designated Overhaul Point (DOP). The net effect of this criteria is to not expend large amounts of manpower, materials and money to effect a CER/First Degree Repair at such a close period in time



AIRCRAFT INTERMEDIATE MAINTENANCE DEPARTMENT
SCREENING SEQUENCE PROCEDURE FOR REJECTED ENGINES

Figure 7



FIRST DEGREE INTERMEDIATE MAINTENANCE
ACTIVITY SCREENING SEQUENCE FOR
REJECTED ENGINES

Figure 8

to the scheduled overhaul. In general, a CER/First Degree Repair effort involves a near-complete teardown of the engine. Then, if the 75% Maximum Operating Time criteria applies, it would be more cost effective to institute the overhaul rather than the CER/First Degree Repair.

Additional criteria which apply in the case of CER/First Degree maintenance includes:

1. Direct Manhours (DMH) required to effect repair compared to DMH's to effect overhaul.
2. Turnaround Time (TAT) required to effect repair in excess of 30 days.
3. Engine state of teardown.

Each criteria functions to ensure that a rejected engine is maintained at the lowest practical and cost effective level. [Ref. 8]

A significant feature of the three degree concept as currently employed for intermediate level activities is that a procedure does exist for an activity to either up-grade or down-grade its degree designation commensurate with changes in support requirements. The procedure applies for instances in which the complement of aircraft engine Type/Model/Series changes significantly. Should the aircraft engine complement reduce in quantity to a level that certain authorized maintenance functions are not performed with as great a frequency, and, consequently, certain resources are not effectively employed, the activity may submit a request to NAVAIR for change in degree maintenance responsibility. Similarly, an activity that experiences a significant increase in the requirements to perform maintenance functions not previously authorized may do so through the same channels as in the former case. NAVAIR receives and evaluates

all proposed changes in degree maintenance designations. A recommendation is forwarded to the Chief of Naval Operations by NAVAIR based upon its evaluation of each request. The Chief of Naval Operations either approves or rejects the request. Appropriate changes are made throughout the maintenance community in consonance with the Chief of Naval Operations decision. All assignments of first, second, and third degree designated activities are recorded in NAVAIR Notice 4700 which is updated annually. [Ref. 9]

IV. MAINTENANCE DATA SYSTEM

A. PURPOSE OF MDS

The purpose of the Maintenance Data System (MDS) is to document, analyze and employ data for the management of aviation maintenance and material support. The MDS was developed as integral part of the 3-M Data System to provide the data input to the Naval Aviation Maintenance Program (NAMP). This system furnished data products which provide management tools for the efficient and economical management of maintenance organizations.

The 3-M Data System is sponsored by the Chief of Naval Operations (CNO) and administered through the operating chain of command. Technical support is provided by the Chief of Naval Material (CNM) and Naval Air Systems Command (NAVAIRSYSCOM). The MDS is a management information system designed to provide statistical data for use at all echelons for:

1. Maintenance personnel utilization
2. Equipment maintainability and reliability

3. Equipment configuration

4. Equipment readiness and utilization

5. Maintenance material usage

6. Material non-availability

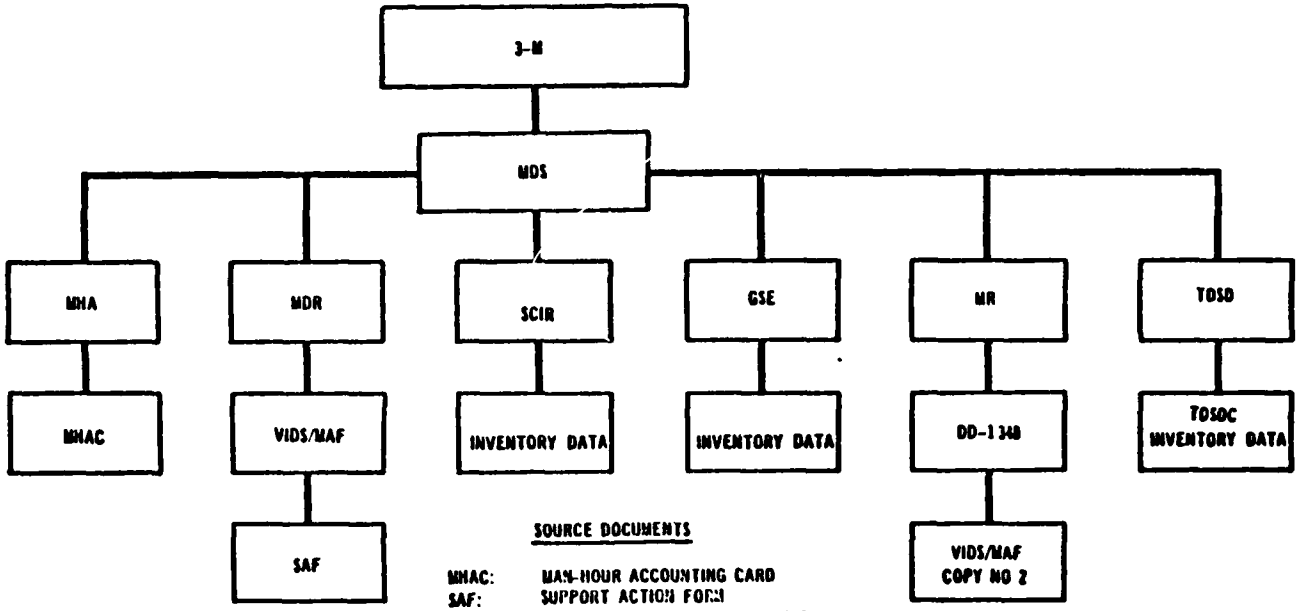
7. Maintenance material processing times

8. Weapon system and maintenance material costing

The 3-M Data System is a handy, ready way to collect data for use primarily by the fleet, and also for all the other users up and down the line. [Ref. 10]

B. DATA FLOW

It all begins at the Organizational level with a Visual Information Display System/Maintenance Action Form (VIDS/MAF) which is the basic source document. All the maintenance data is collected on a VIDS/MAF or on a Support Action Form (SAF), including all adjustments that are made (Figure 9). The VIDS/MAF collects the maintenance data at the source. If a repairable component is involved in the maintenance action, a copy will go with the repairable component to the Intermediate level. If there's merely an adjustment to be performed, we may never do anything more than set up one Maintenance Action Form and that, of course, goes right to a data service facility. With the component that arrives at the Intermediate level, copies of the VIDS/MAF are distributed, as will be described later. If the component is repaired at the Intermediate level, that will end the data flow at that point and forms will be sent to the appropriate locations. If it is Beyond Capability of Maintenance (BCM), copies of the form will accompany the component to the Depot level. [Ref. 11]



SOURCE DOCUMENTS

MHAC: MAN-HOUR ACCOUNTING CARD
SAF: SUPPORT ACTION FORM
VIDS/MAF: VISUAL INFORMATION DISPLAY SYSTEM/ MAINTENANCE ACTION FORM
*MATERIAL REPORTING WILL BE ACCOMPLISHED ON THE DD-1348 AND THE NUMBER TWO COPY OF THE VIDS/MAF
TDUF: TRAINING DEVICE UTILIZATION FORM

Figure 9

ELEMENTS OF THE NAVAL AVIATION MAINTENANCE AND MATERIAL MANAGEMENT SYSTEM (3-M AVIATION)

C. INPUT CONCEPT AND APPROACH

The VIDS/MAF concept provides information in a concise form which simplifies the maintenance documentation effort. It requires minimum manpower and paperwork to maintain, gives maximum maintenance status information to managers, and provides a uniform source document. The VIDS/MAF is the prime source document for maintenance actions. The Support Action Form (SAF), is used to document manhours expended in the maintenance community for actions in general support, various inspections, corrosion control, etc. The Equipment Statistical Data (ESD) card, captures readiness information for aircraft readiness; readiness and utilization data for ground support equipment and training devices. The Naval Aircraft Flight Record (Yellow Sheet) and Flight Readiness Evaluation Data Sheet (FREDS) which is the Marine Corps yellow sheet are filled in by the pilots for every aircraft flight or flight simulator period to collect flight data.

Information collected by these source documents is processed at the local data services facility and sent in the form of punched cards or tape to the Navy Maintenance Support Office (NAMSO). The type of input data that is specified for the Maintenance Data System provides the means by which the Navy measures the effectiveness of its equipment and the planned maintenance systems. The forms used to record the input data are geared to the way the Navy performs maintenance. Every aviation weapon system is cycled through servicing, preflight, flight and postflight, and back again to servicing. The equipment continues in this cycle receiving support action until sufficient calendar time or

flight hours have accumulated to require scheduled maintenance to take place. During scheduled maintenance, corrective maintenance requirements are discovered. Repairs are made and the aircraft is inserted into the cycle again. The majority of the maintenance is unscheduled when discovered during the normal day-to-day operations of the equipment.

As stated before, the Organizational level of maintenance in the Navy deals primarily with removing and replacing components. Once that defective component is removed from the equipment, it is turned into the Intermediate level of maintenance. It is screened and then turned into a shop at the Intermediate level to be repaired, adjusted or found to have no defect. It can also be beyond the capability of the Intermediate level maintenance, in which case it is sent to the Depot level.

D. ADMINISTRATION

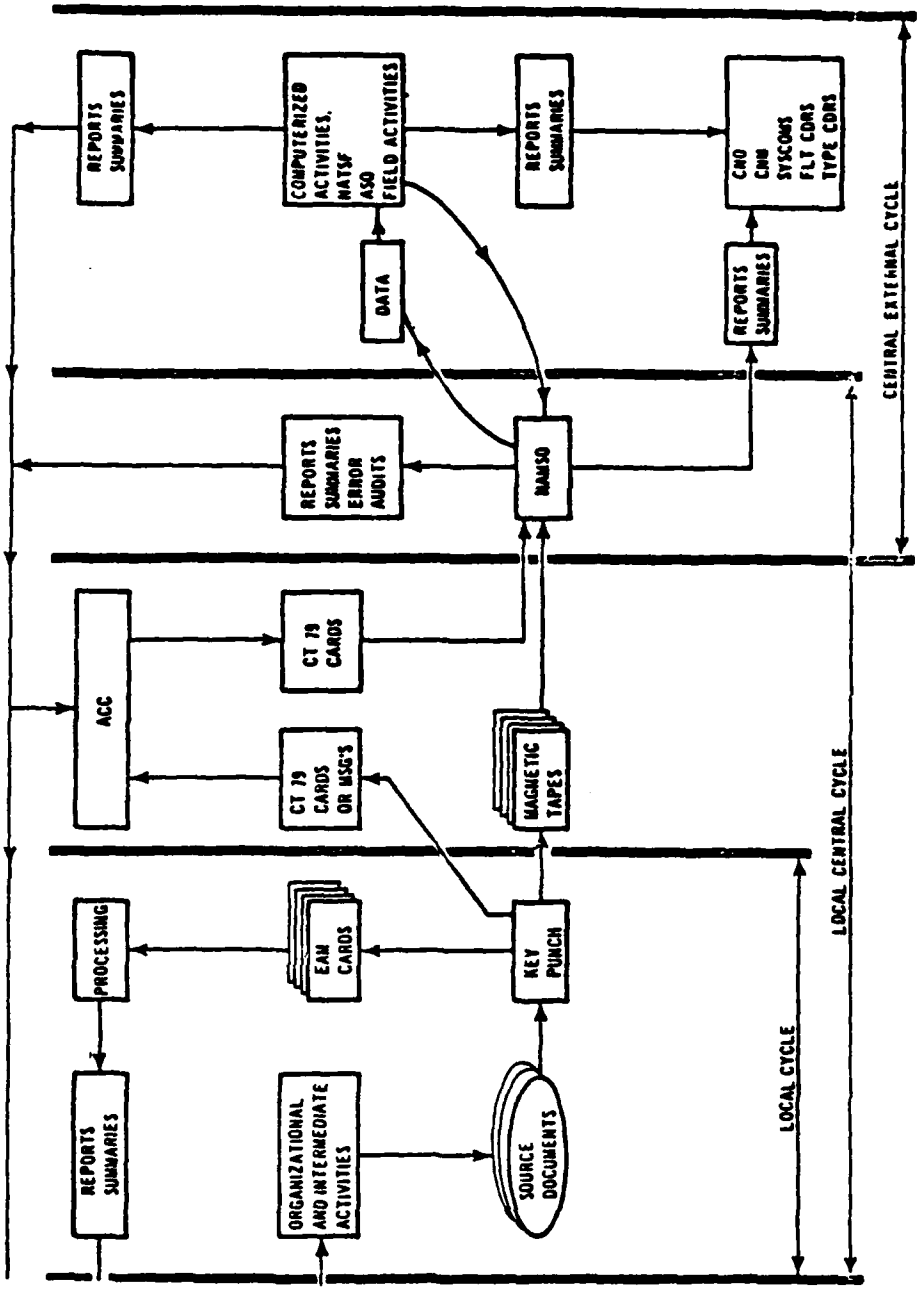
The supervisor of each work center is responsible for the management of all aspects of the MDS at that level. This would include the collection and screening of source documents, and correcting the errors, if any, on the daily audit reports. Communication and coordination with the Analysis Section is paramount in solving any problems that may arise.

An Analysis Section is established in each organizational and intermediate level maintenance activity to monitor, control, and apply the MDS within the activity. As the contact point between the work centers and the Data Service Facility (DSF), this section has the responsibility for the management of all aspects of the MDS at the activity level. The Analysis Section is responsible for the collection, screening, and forwarding of all source documents. They must screen, distribute, and

analyze machine reports and train maintenance department personnel in MDS documentation procedures. Communication and coordination with the work centers and the DSF is essential to resolve any problem areas. [Ref. 12]

The Data Service Facility (DSF) has the main responsibility of converting the data entered on the source documents into machine sensitive records, and to produce any prescribed outputs for the reporting organization and any external recipients as required (Figure 10). This output includes a series of daily audit reports which the reporting activity receives the day following submission of the source documents. These reports are used to verify the previous day's inputs. At the completion of each month, the DSF provides monthly reports for each reporting activity, if requested, and forwards MDS data to higher commands and to the central data bank at NAMSO. A history file must be maintained of the current data until NAMSO notifies DSF that the data was received and processed. The local DSF cannot modify standard computer software/operating procedures. If a change is required, the change will be carried out by the Lead Programming Activity.

The MDS is a very unique as it is required to operate on a wide variety of Automatic Data Processing (ADP) hardware systems in a great many geographic locations. This imposes a considerably complex programming requirement and complicates coordination and management of the system. A Lead Programming Activity (LPA) has been designated to provide system analysis and programming services for each facility with identical ADP hardware. They are responsible for the design, documentation and maintenance of the ADP so as to operate the system successfully.



AVIATION 3-M DATA CYCLES

Figure 10

If any revisions in software are required, the LPA will prepare, distribute, and implement the necessary changes.

The Navy Aviation Maintenance Support Office (NAMSO) has the basic operation and central data base maintenance responsibility for the system. Data pertaining to any aspect of the maintenance effort of material usage may be extracted by management at any level of command. NAMSO receives all transactions, using the VIDS/MAF and other source documents from the fleet, Intermediate and other maintenance data contributors. The data base is updated monthly from these inputs, and the output reports are printed and distributed. The NAMSO also has the responsibility for satisfying new requirements and maintaining the system in effective operating order. [Ref. 13]

E. DATA VALIDATION AND CORRECTION

MDS source documents are forwarded to the DSF for machine processing on a daily basis from the reporting activity. As data from the source documents are extracted and converted to machine sensitive formats, each data element that enters the MDS must be validated to a prescribed set of validation specifications. In the case of relational validation, only the data element failing validation will be flagged. If data is found to be erroneous, that element will be flagged on the applicable daily audit report and corrective measures must be taken.

To the maximum extent possible, data base errors should be corrected as they are identified on a daily basis. Reporting activities will submit MDS source documents to their local DSF for processing on a daily basis. If data errors are noticed during the key punch operation, the DSF may elect to circle the erroneous/illegible data elements in red and

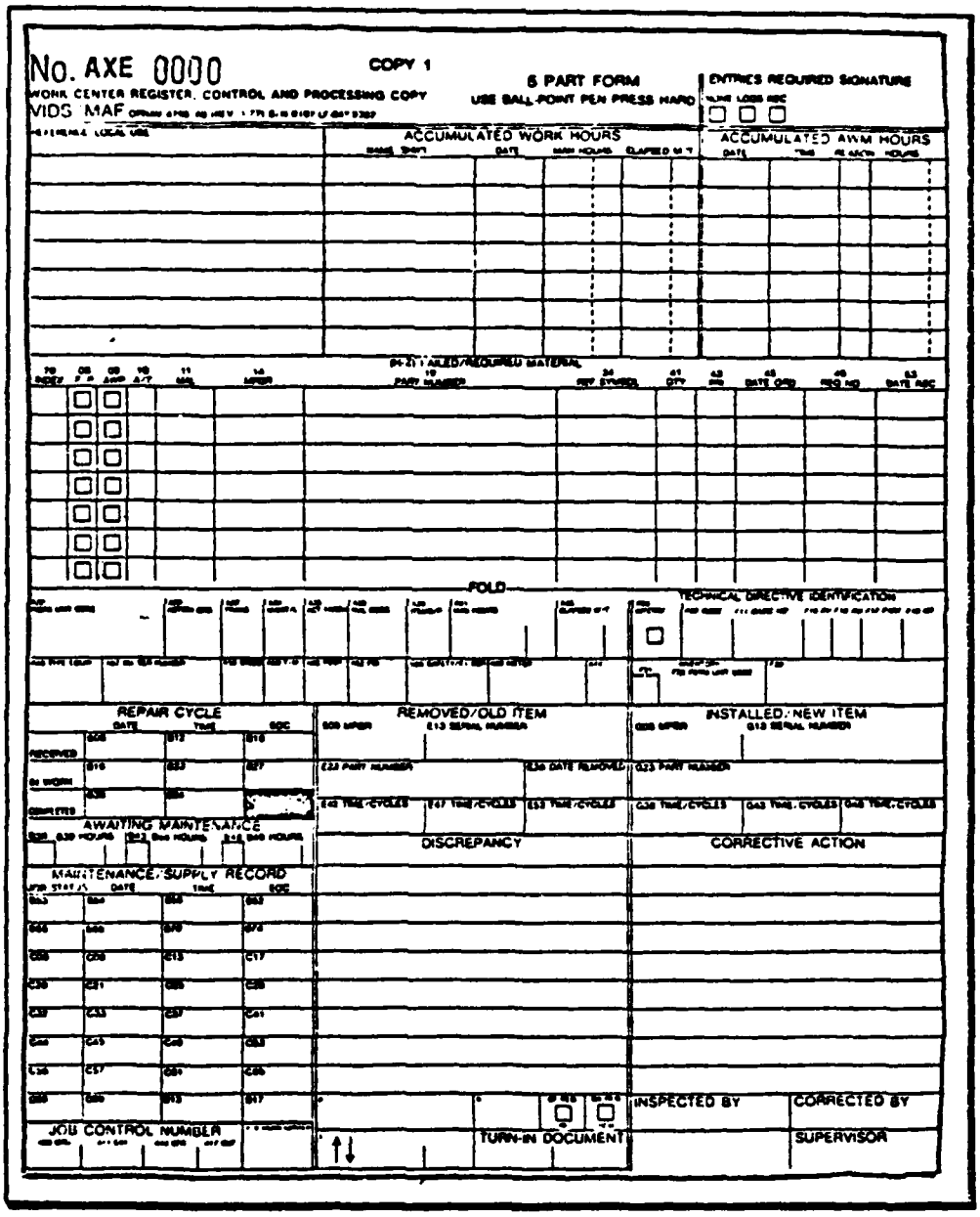
return the source document to the reporting activity for correction and resubmission. If the data errors are not noticed during the key punch operation, the system will validate all input records and identify all data errors on the applicable daily audit reports. [Ref. 14]

F. VIDS/MAF FORM

The VIDS/MAF Copy 1 is a five-part form which was recently developed as the single document for use as a management tool and maintenance data collection source. Prior to VIDS/MAF, there were 10 different forms used to manage or collect data for the 3-M Data System. These forms have just about all been eliminated by the VIDS/MAF.

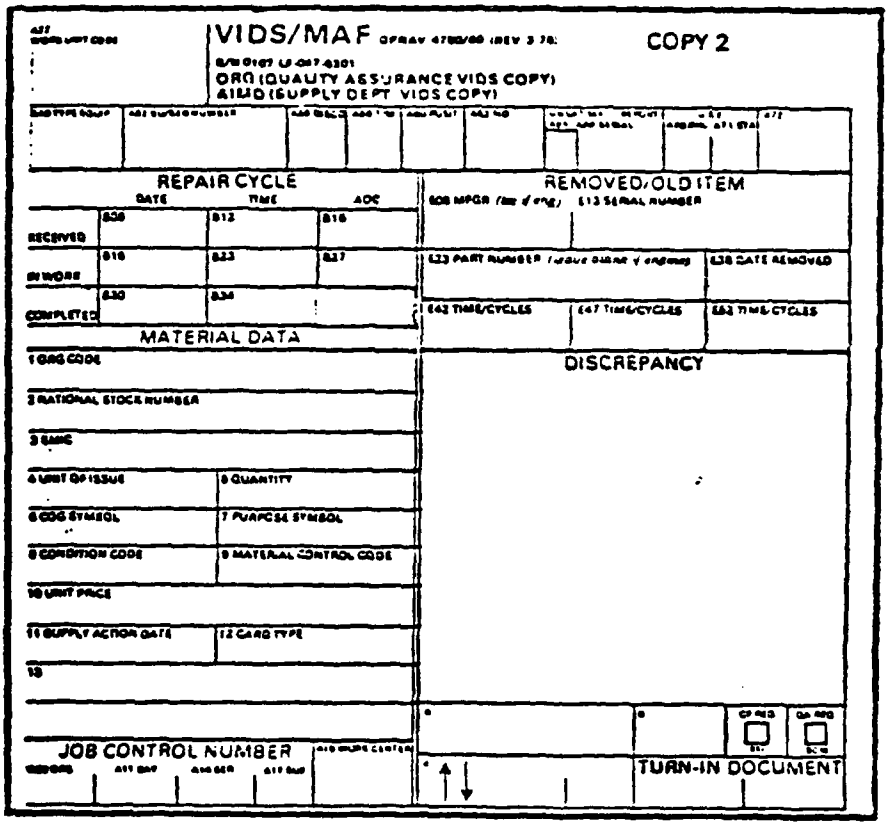
To have complete documentation five copies are necessary. Maintenance control retains the first part of each maintenance action form and keeps it on the Visual Information Display Status (VIDS) board (Figure 11). Maintenance control must have this status for every ongoing maintenance action or pending maintenance action for the unit. The second part is for Quality Assurance. They use this to determine trends on certain equipment or on certain aircraft so as to prevent components on the aircraft from breaking and requiring maintenance, time and time again. Two of the parts must be forwarded to the functional shop which is actually doing the work. The fifth and last part is kept in the aircraft discrepancy book which the pilot reviews prior to flight.

Copy 2 of the VIDS/MAF serves as a suspense document for repairable component pool management while the defective component is being processed by the Intermediate Maintenance Activity (IMA) (Figure 12). Upon completion of the IMA action the component is returned to the supply



VIDS/MAF Copy 1

Figure 11



VIDS/MAF Copy 2

Figure 12

organization, and at this point blocks 1-12 are completed by the Supply Support Center and Copy 2 is submitted to the DSF for processing. By the transaction code entry in block 12, this document records whether the component was repaired by the IMA and returned to Ready-For-Issue (RFI) status, or was Beyond Capability of Maintenance (BCM) at the IMA. [Ref. 15]

G. SUMMARY

The main data-entry form of VIDS/MAF is supplemented by the Equipment Statistical Data and Support Action Forms. These are the three basic forms that are used to measure direct maintenance, maintenance performed, readiness of the aircraft and the support manhours required to maintain that level of readiness.

Analysis of the data input to the MDS will indicate the reliability of equipment and efficiency of the maintenance and supply systems. The VIDS/MAF form is used in the day-to-day management of the Naval Aviation Maintenance Program (NAMP).

V. 3-M AVIATION INFORMATION REPORT

A. AIMD ENGINE MAINTENANCE EVALUATION REPORT

This quarterly and cumulative annual report contains a summary of the number of aircraft engines processed through an Aircraft Intermediate Maintenance Department (AIMD) and the percent of engines accomplishment (Figures 1 and 2). This data in the report is used by the Naval Air Systems Command as a source for selecting the outstanding intermediate maintenance activity for the Villard C. Sledge Memorial Maintenance Award. [Ref. 16]

The data used in the report was obtained from reports submitted by the AIMD/IMA under the Naval Aviation Maintenance and Material Management System (3-M System). The 3-M report forms utilized are VIDS/MAF, OPNAV forms 4790/59 and 4790/60, transaction codes 31 and 32.

Transaction code 31 is work performed on a removed repairable component/item with no failed parts, awaiting parts, or engine identification documented in the Failed/Required Material blocks. This code will be used on engine documents only when the engine is not specifically identified to a particular aircraft. Transaction code 11 has supporting engine documents which are used for on-equipment work, not involving removal of defective or suspected defective components/items. Also it is used on supporting engine documents, not having a removal of a defective or suspected defective component/item, when the engine is not specifically identified to a particular aircraft and when the intermediate level maintenance activities are closing out a maintenance action.

Transaction code 32 is used when work performed on a removed repairable component/item with failed parts, awaiting parts, cannibalization actions, or engine identification documented in the Failed/Required Material blocks.

This report is restricted to jet, turboprop and turbofan engines. Below is the explanation for the contents of each heading in the report:

1. *ENGINE: The identification of the engine on which maintenance* was performed as reported on the VIDS/MAF document. The comment unknown series (unk-series) will be displayed if the actual engine identification cannot be determined.

2. ACTIVITY: The identification of the Aircraft Intermediate Maintenance Department accomplishing the maintenance action.

3. TOTAL ITEMS PROCESSED: The number of aircraft engines processed through an intermediate level maintenance activity as reported in VIDS/MAF records with a transaction code of 31 or 32 when the main tenance level is second or third and the Action Taken Code is A, C, 0, or 1 through 9.

4. ATC C ITEMS (Action Taken Code C Items): The number of aircraft engines which were repaired by the Aircraft Intermediate Maintenance Department as reported in VIDS/MAF records with a transaction code of 31 or 32 when the Action Taken Code is C.

5. TOTAL BCM ITEMS (Total Beyond Capability of Maintenance items): The number of aircraft engines beyond capability of maintenance by the Aircraft Intermediate Maintenance Department as reported in VIDS/MAF records with a transaction code of 31 or 32 when the Action Taken Code

is 1 through 9. Additionally, a separate breakdown of each BCM code 1 through 9 is provided.

6. ATC 0 ITEMS (Action Taken Code 0 items): The number of aircraft engines on which major inspections were accomplished by the Aircraft Intermediate Maintenance Department as reported in VIDS/MAF records with a transaction code of 31 or 32 when the Work Unit Code begins with 03 and the Action Taken Code is 0.

7. BCM 1 MAL 803/807 ITEMS: The number of aircraft engines that were removed for high time or directed by higher authority that were beyond the repair capability of the Aircraft Intermediate Maintenance Department as reported in VIDS/MAF records with a transaction code of 31 or 32 when the Action Taken Code is 1 and the Malfunction Description Code is 803 or 807 (no defect--removed for time change or no defect--removed directed by higher authority, respectively).

8. ATC A ITEMS (Actions Taken Code A items): The number of aircraft engines where the reported deficiency could not be duplicated during the Aircraft Intermediate Maintenance Department processing as reported in VIDS/MAF records with a transaction code of 31 or 32 when the Action Taken Code is A.

9. PERCENT BCM RATE: The Beyond Capability of Maintenance items divided by the Total Engines Processed. Although high time engines and higher authority directed engine removals (BCM 1, MAL Codes 803/807) are included in the BCM Rate, they are also counted as an asset when computing the percent accomplishment. A separate percentage is provided for each Beyond Capability of Main tenance Code 1 through 9.

10. PERCENT ACCOMPLISHMENT: Those engines which have been repaired (ATC C), tested and returned to service (ATC A), inspected (ATC 0), preserved and packaged as high time for return to overhaul (HOW MAL 803), or (HOW MAL 807) divided by the total number of engines processed. [Ref. 17]

B. ACTION TAKEN CODE

The Action Taken Code is a one-character alphabetic or numberic code that describes the action that has been taken (that is recorded on VIDS/MAF). This code describes what action has been performed on the item identified by the Work Unit Code (WUC). Action Taken Codes that are utilized in the award selection are defined and explained below:

1. Code 1: BCM--Repair Not Authorized. This code is entered only when the activity is specifically not authorized to repair the item in applicable directions. This code will be used only if no other code is appropriate.

2. Code 2: BCM--Lack of Equipment, Tools or Facilities. This code is entered when the repair is authorized but cannot be performed because of lack of equipment, tools, or facilities.

3. Code 3: BCM--Lack of Technical Skills. This code is entered when repair is authorized but cannot be performed because of a lack of technical skills.

4. Code 4: BCM--Lack of Parts. This code is entered when repair is authorized but cannot be performed because required parts will not be available within guidelines established by applicable directives.

5. Code 5: BCM--Fails Check and Test. This code is entered when the activity's authorized level of main tenance is limited to check and test only, and repair is required.

6. Code 6: BCM--Lack of Technical Data. This code is entered when repair is authorized but cannot be performed because of a lack of technical data.

7. Code 7: BCM--Beyond Authorized Repair Depth. This code is entered when some level of repair beyond check and test is authorized but the depth of repair required to return the component to an RFI condition is beyond the activity's authorized repair level as indicated in applicable directives, such as maintenance plans, maintenance manuals, etc.

8. Code 8: BCM--Administrative. This code is entered when repair is authorized and feasible but not attempted due to budgetary limitations, excessive backlog, or requirements in excess of materials. Such determinations can be made jointly by the maintenance and supply officers.

9. Code 9: BCM--Condemned. This code is entered when a repairable item is so severely worn or damaged that repair is not feasible. The item is locally condemned and returned to the Supply Department for survey, retrograde or scrap, as appropriate, in accordance with applicable directives.

10. Code 0: This codc is used on all source documents recording look-phase man-hours for Acceptance/Transfer, Conditional and Calendar Inspections including the closeout of man-hours on the look-phase of those inspections at the end of the reporting period.

11. Code A: Item of Repairable Material or Weapons/Support System Discrepancy Check-No Repair Required. This code is used for all discrepancies when checked and found that either the reported deficiency cannot be duplicated, or the equipment is operating within allowable tolerances. Adjustments may be made under this code if the purpose of

the adjustment is to peak or optimize performance. When adjustments are made, the Malfunction Code should reflect the reason for the adjustment. If the purpose of the adjustment is to bring the equipment within allowable tolerances, Action Taken Code C should be used.

12. Code C: This code is entered when a repairable item of material which is identified by Work Unit Code (WUC) is repaired. Repair includes cleaning, disassembly, inspection, reassembly, lubrication, and replacement of integral parts; adjustments are included in this definition if the purpose of the adjustments is to bring the equipment within allowable tolerances. This code also applies to the correction of a discrepancy on a Weapons/Support Systems, when appropriate. [Ref. 18]

C. MALFUNCTION DESCRIPTION CODE

The Malfunction Description Code is a three-character alphanumeric code used on VIDS/MAF forms to describe the malfunction which causes the maintenance action on the item described by the Work Unit Code (WUC). Conditional malfunction codes are those which describe a malfunction due to an induced condition other than material failure. Conditional malfunctions include battle damage, improper maintenance and/or handling, malfunction of associated equipment, etc. Malfunction codes that are utilized in the award selection are conditional codes. The first is code 803 which is no defect--removed for time change. The second is no defect--removal directed by higher authority.

VI. CONCLUSIONS

Historically, intermediate maintenance activities have experienced defacto degrees of component maintenance due to limitations of required maintenance support resources such as trained personnel, test equipment, material support, etc. Intermediate level activities were encouraged to perform all possible maintenance short of overhaul. This situation has caused activities to compete for scarce resources in order to satisfy experienced maintenance requirements. While this "can do" attitude was commendable from the Fleet Commander's viewpoint, it did not necessarily result in the most efficient or cost-effective utilization of resources.

The Three Degree Jet Engine Maintenance Program is a practical and cost-effective maintenance support concept at the intermediate level of maintenance. By identifying specific maintenance responsibilities and corresponding resource requirements, the maintenance support posture of each individual AIMD/IMA will be enhanced through more effective allocation of resources in conjunction with specific assignment of responsibilities. Any practices which circumvent the system just so the AIMD/IMA can meet maintenance requirements does raise overall cost of maintaining components in the Fleet. When this practice is eliminated the operational readiness, as related to material readiness, should improve Fleet wide.

It is my opinion that the loopholes that were thought to exist in the criteria for selection of the Sledge Award for excellence in

intermediate aircraft engine maintenance do not exist to any great extent. The only recommendation that could be made would be to reduce the minimum number of engines to be inducted as follows:

1. First Degree - change 50 to 40 engines.
2. Second Degree - change 20 to 15 engines.
3. Third Degree - remain the same at 10 engines.

Due to the complexity of this award in dealing with the different Aircraft Intermediate Maintenance Departments (AIMD's), there are peculiar problems with different engine models and serials that it would be appropriate for a long term site study of each AIMD/IMA be undertaken so that anomalies that affect only a few AIMD's can be factored into the award structure. Some of these anomalies would be; direction to BCM from higher headquarters, components repaired, depth of repair accomplished, etc.

The Sledge Award is a valuable tool to maintain maintenance excellence and morale within the naval aviation community and thus should use the most judicial methods in assuring that the most qualified activities continue to receive the award. The apparent effect of the Sledge Award has been to motivate activities to do their best for assigned degree of maintenance responsibilities. The atmosphere of competitiveness created by the awards program makes it apparent that individual AIMD's/IMA's are motivated to excel in their respective degrees of responsibility for aircraft engines supported. After the awards have been made each year, the non-recipients respond "maybe next year." Such an attitude should provide for enhancement of the jet engine maintenance support posture.

APPENDIX A

TERMINOLOGY

ENGINE: All turbine engines, whether used for powered flight, for auxiliary power or for starting purposes.

REPAIR: The restoration of a damaged or non-operating engine, its accessories or components, to an acceptable condition. Repair by designated Aircraft Intermediate Maintenance Departments (AIMD) includes the repair/replacement of turbine and combustion sections of the engine and includes the after burners. Additional repair functions include the replacement of externally damaged, deteriorated or time limited components, gear boxes or accessories of the engine and the conduct of calendar inspections.

COMPLETE REPAIR: Applies to the maintenance of gas turbine engines to a depth which includes and goes beyond that maintenance authorized for non-CER designated activities. Complete repair does not include maintenance functions that are equivalent to performing depot overhaul.

FIRST DEGREE REPAIR: Applies to the performance of CER maintenance functions. It includes compressor rotor replacement and/or disassembly of the engine to a depth that the compressor rotor can be removed.

SECOND DEGREE REPAIR: The repair of a damaged or non-operating engine, its accessories or components, to an acceptable operating condition. It includes the repair/replacement of turbine rotors and combustion sections and the after burners.

THIRD DEGREE REPAIR: Encompasses the same gas turbine engine maintenance capability as second degree except that certain functions which require high maintenance man-hours and are of low incident rate are excluded.

FIRST DEGREE REPAIR ACTIVITY: A maintenance activity authorized to perform First Degree Repair/CER. A First Degree Repair Activity is capable of performing Second and Third Degree Repair functions.

SECOND DEGREE REPAIR ACTIVITY: An activity authorized to perform Second Degree Repair. A Second Degree Repair Activity is capable of performing Third Degree Repair functions.

THIRD DEGREE REPAIR ACTIVITY: An activity authorized to perform Third Degree Repair.

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